Appendix A
Benefiting Alaska's Economy: ADF&G's Region II & III Recreational Stocking Programs

northerneconomics inc.

Memorandum

To: Bud Alto, Project Manager
CH2MHILL

From: Jonathan King, Economist
Northern Economics

Date: May 21, 2004

Re: Hatchery Valuation Analysis—Final Memo

Introduction

This document serves as the final project memo for the Hatchery Valuation Project funded by the Alaska Department of Fish & Game (ADF&G) through CH2M-Hill. This memo describes the project's goals, findings, methodology and data, and references cited.

Project Goals

The goals of this project are to:

- Provide ADF&G with an estimate of the yearly value to the State of Alaska's economy of the Department's recreational hatchery stocking program;
- Calculate the present value of the stocking program over the next 20 years based on results from the first part of the analysis.

The project's work product includes this memo and a spreadsheet model.

Results Summary

Stocking Program Economic Effect

The analysis estimates that over the last five years the fishing effort associated with ADF&G's Region II and III stocking programs contributed between $19.2 million (average lower bound estimate) and $49.1 million (average upper bound estimate) annually to the Alaska economy and created roughly 330,000 angler days per year. Table 1 shows an average of estimates for the 1998 through 2002 period, as well as specific yearly estimates. Yearly estimates are apportioned into resident and non-resident categories. The analysis estimates the effect of average resident expenditures on the economy at between $8.0 million and $22.2 million, while the average effect of non-resident expenditures ranges from $11.2 million to $26.9 million.

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Table 1. Estimates of Yearly Contribution to the State's Economy

Year	Lower Bound Resident Value	Lower Bound Non-Resident Value	Total Lower Bound Value	Upper Bound Resident Value	Upper Bound Non-Resident Value	Total Upper Bound Value
1998	$6,735,398	$9,777,060	$16,512,458	$18,688,431	$23,269,950	$41,958,381
1999	$8,385,556	$11,192,771	$19,578,327	$24,267,570	$27,114,545	$51,382,115
2000	$9,252,440	$13,069,837	$22,322,276	$26,015,055	$31,119,126	$57,134,181
2001	$7,715,027	$11,274,214	$18,989,242	$21,306,845	$26,652,460	$47,959,306
2002	$7,560,645	$11,077,536	$18,638,181	$20,855,125	$26,200,205	$47,055,329
Average	$7,929,813	$11,278,283	$19,208,097	$22,226,605	$26,871,257	$49,097,862

Note: All values are in 2001 dollars.

The estimated 20-year present value is between $282 million and $722 million with an average estimate of $502 million. These estimates are based on a real discount rate of 3.5 percent (Federal Register 2004).[1] These estimates are robust and relatively insensitive to changes in discount rates. Increasing the discount rate to the Alaska Permanent Fund average real rate of return of 5.3 percent provides a 20-year present value range of $245 million to $628 million.[2]

Table 2. Estimated Average 20-Year Present Value of Hatchery Stocking Program's Economic Effect

Category	Lower Bound PV	Upper Bound PV
Average Resident PV	$116,646,262	$326,949,748
Average Non-Resident PV	$165,901,716	$395,271,825
Average Total 20-Year PV	$282,547,978	$722,221,574

Note: All values are in 2001 dollars.

Distribution of Effect and Angler Days

Based on an average effect of $34.2 million dollars per year, non-resident anadromous angling accounts for 51 percent of the study program's economic effect. Resident anadromous and resident non-anadromous account for 24 percent and 20 percent respectively. Non-resident, non-anadromous days account for only 5 percent of the program's total economic effect (See Figure 1).

The stocking program is highly successful at attracting resident anglers. Resident days account for more than 80 percent of total angler days attributable to the program. Figure 2 shows while non-resident anadromous days make up the majority of the economic effect, this same angling category only accounts for 16 percent of days we attribute to the program. Non-resident, non-anadromous account for less than two percent of total hatchery program-attributable day. This small percentage, and a total number of days less than 10,000, indicates that the program could be more successful at promoting stocking-related, non-anadromous angling experiences to out-of-state anglers.

[1] This discount rate is the Federal Office of Budget and Management's official 30-year discount rate for federal projects.

[2] These values should not be confused with the net present of the program. A net present analysis would have to subtract the program's cost from the values presented above to reach a net present value number.

Figure 1 Distribution of Economic Effect Across Angling Category

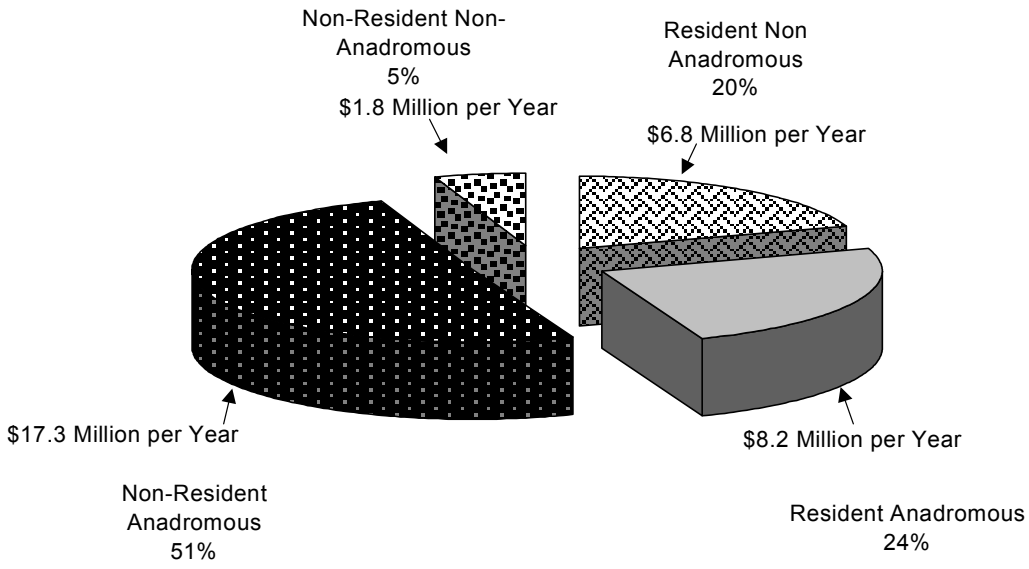
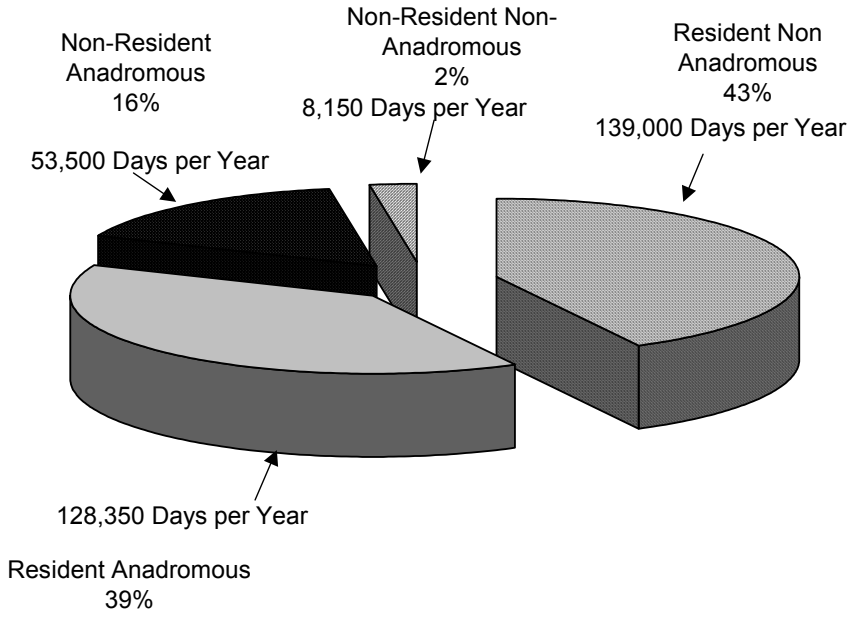


Figure 2 Distribution of Angler days by Angling Category

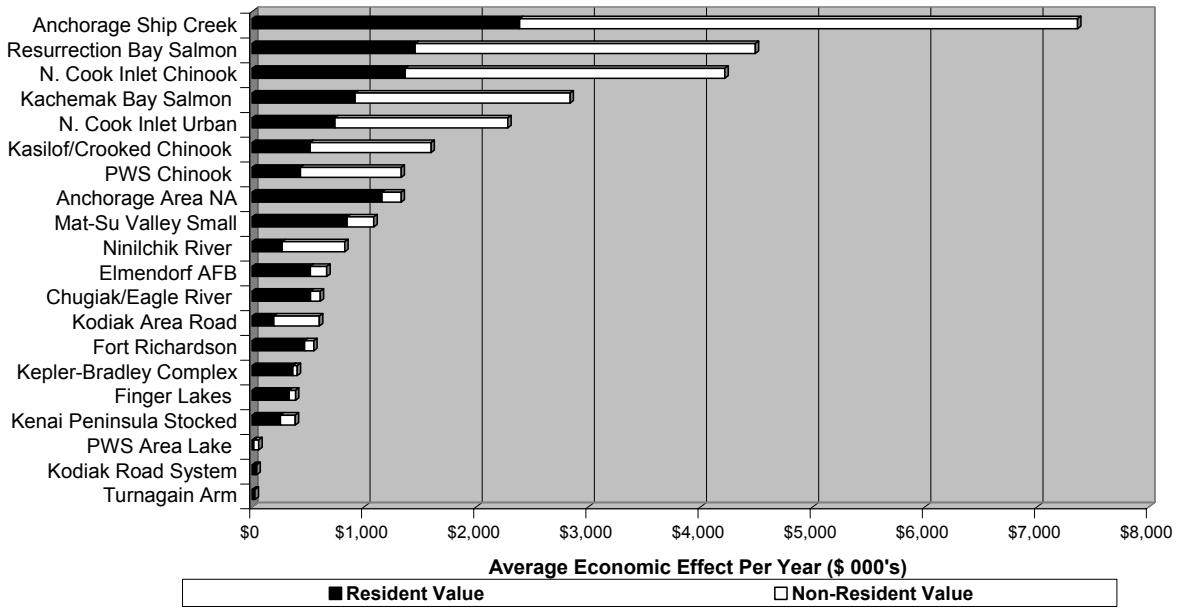


Economic Effect and Angler Days by Program

The average yearly economic effect varies widely across the stocking programs (see Figure 3).[3] The Anchorage Urban Chinook Salmon Program, which stocks Ship Creek in Anchorage, has both the highest number of user days per year and the highest economic effect per year. The program provides angler days worth nearly $7.3 million per year to the State's economy, an amount nearly as large as the next two programs combined. The economic effect of this program is high because of the high number of anadromous days and the large number of out-of-state anglers. The next six programs by size of economic effect are also exclusively anadromous, and have high numbers of out-of-state angler days.

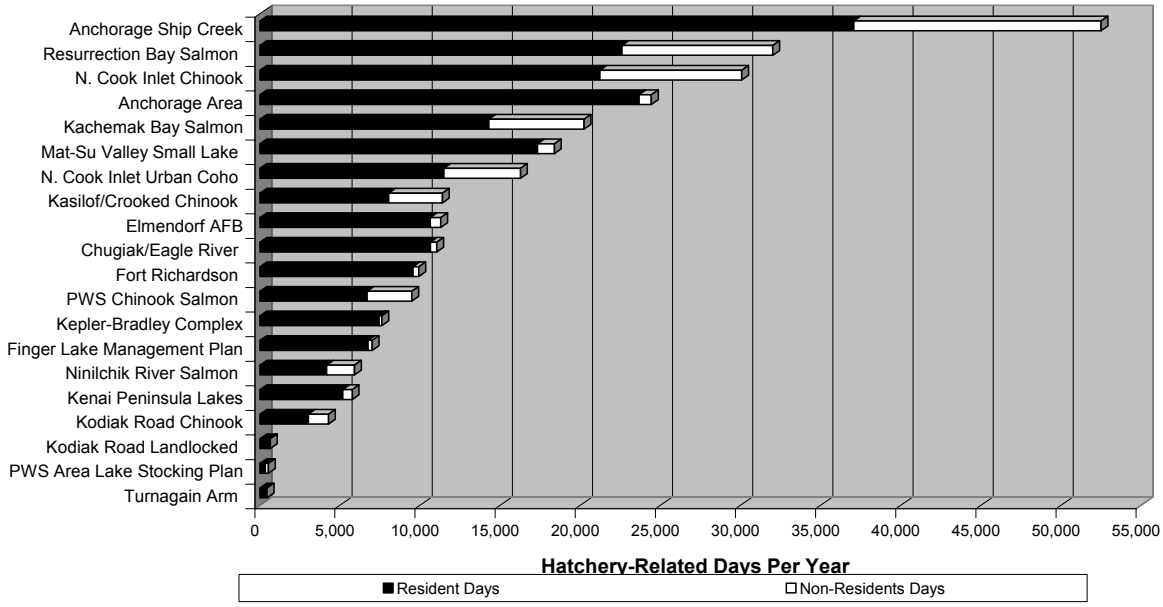
The largest non-anadromous program is the Anchorage Area Non-Anadromous program. This program ranks seventh within the region by economic effect, but fourth by total days. Additionally, this program provides for more in-state angler days than any program other than the Ship Creek program (see Figure 4).

Figure 3. Average Yearly Economic Effect for Region II Programs



[3] Appendix A contains tables with program-by-program estimates of yearly economic value.

Figure 4. Average Angler Days Per Year for Region II Programs



Region III programs also tend to vary widely in both days and total economic effect (see Figure 5 and Figure 6). The largest program by economic effect is the Quartz Lake program, which generates nearly $700,000 per year in economic effect and 11,800 angler days per year. This figure makes the program the eleventh most valuable program in the study by economic effect and eighth most popular by angler days. Overall, Region III programs tend to generate smaller values than Region II programs because they do not have anadromous fishing opportunities. Consequently they attract fewer high-value out-of-state angler days.

Figure 5. Average Yearly Economic Effect for Region III Programs

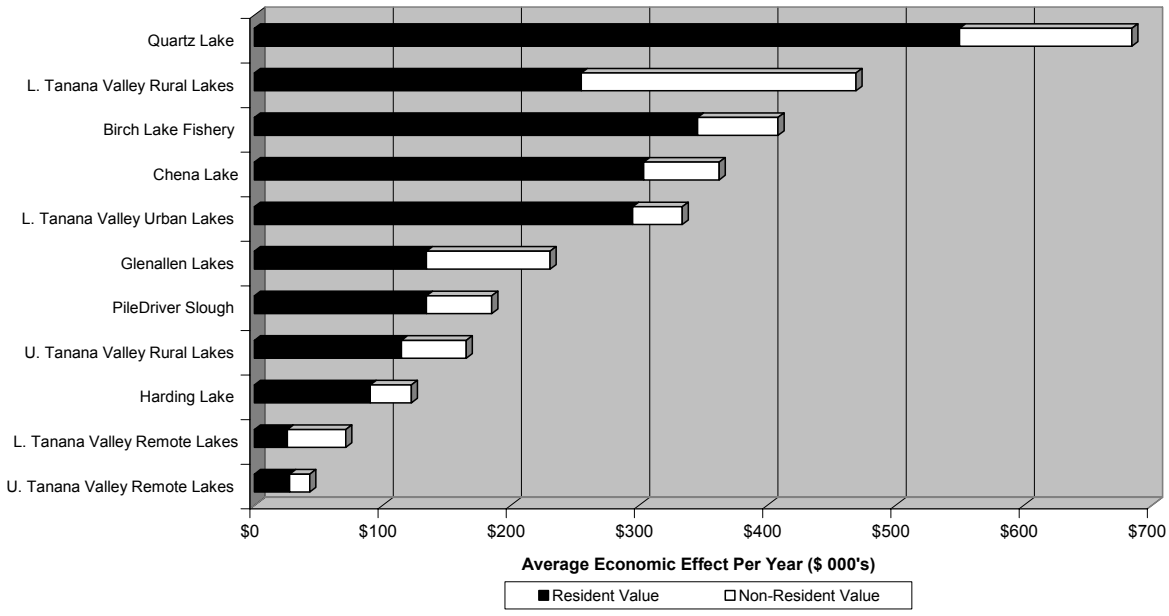
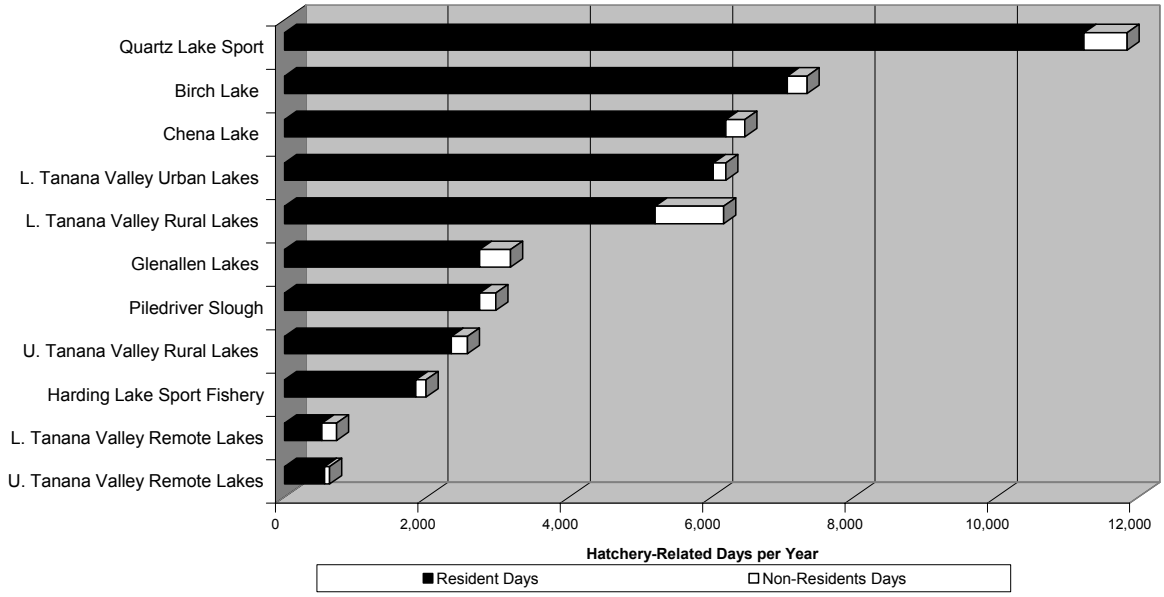


Figure 6 Average Angler Days Per Year for Region III Programs



State Hatchery Program Comparison

Comparisons to other state hatchery programs are hampered by the lack of available equivalent studies and the age of those studies that are available. However, from the limited information that is available, it is evident that the stocking programs in Region II and III provide comparable, possibly superior, opportunities to anglers. Based on comparisons to the *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (Alaska Edition)* and the State's own harvest survey, the stocking program provides between 10 and 14 percent of all angler days in Alaska and accounts for between 4 and 9 percent of all angling-related expenditures. Our calculations show that the stocking program provides 0.5 days of angling for every person living in Alaska. A 1987 Montana survey showed that state's stocking program provided 0.14 days per person (State of Montana 1987). We also believe the program provides excellent value for the cost. Other states spend similar amounts for much smaller returns. For example, Minnesota spends $2 million per year to stock a single species (walleye). Their return is 14 percent of walleye fishing effort attributable to stock (Smith 2004).

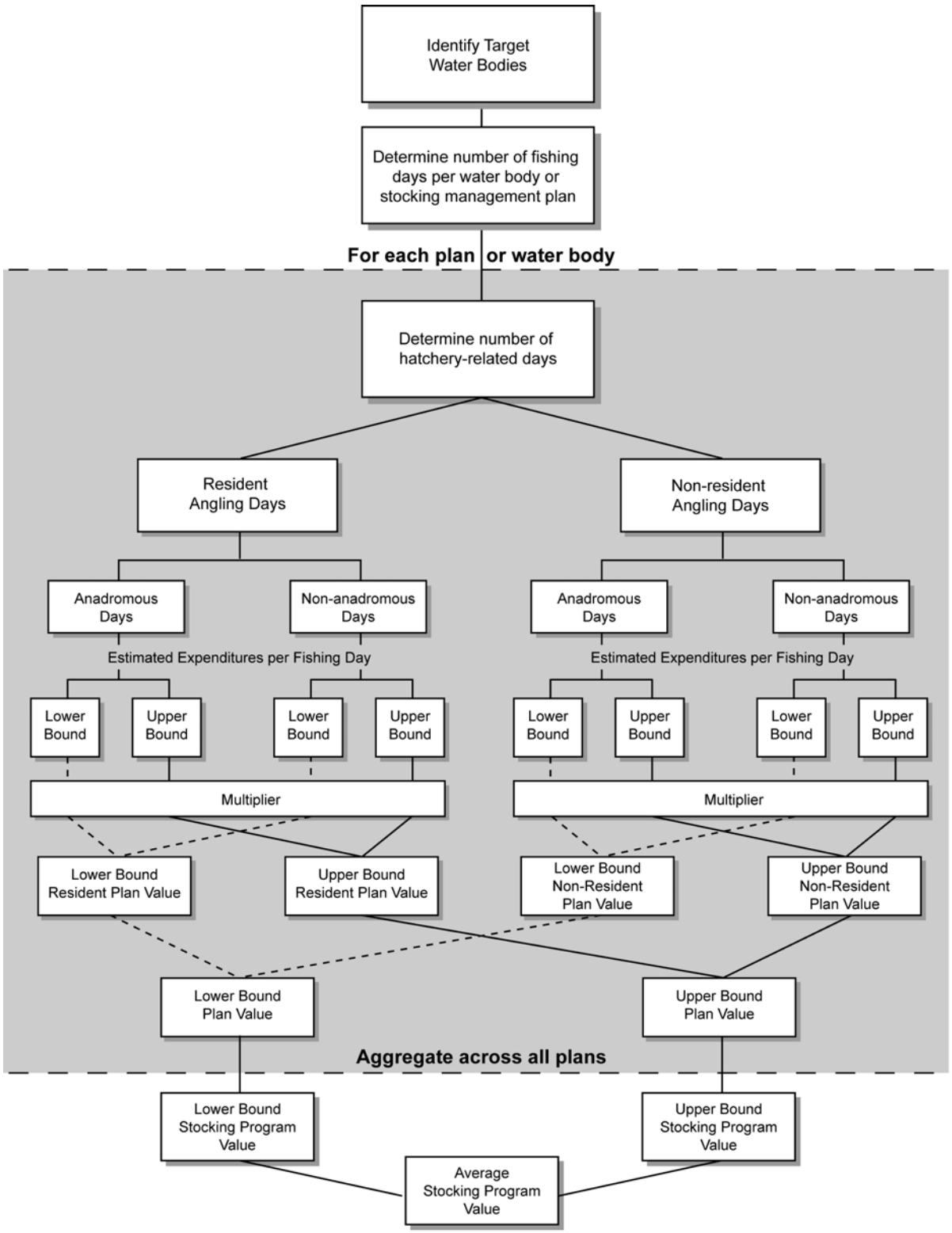
Methodology and Data

The basic steps for this project included:

- Identify the target water bodies; calculate the estimated angler days at each water body;
- Calculate the estimated percentage of these days attributable to the hatchery program;
- Place an expenditure value on each day;
- Employ a multiplier to transform the direct expenditure value to an economic effect;
- Aggregate the value across all water bodies or stocking management plans;
- Calculate the present value of the program over the next 20 years.

Figure 7 shows this methodology graphically.

Figure 7. Analysis Methodology



The methodological steps are described in further detail below.

Identify Target Water Bodies

The first step in the project was identifying the stocked water bodies for estimating the number of angler days. The analysis used the lakes and rivers identified by the Alaska Department of Fish & Game's Statewide Stocking Plan. Our survey indicated that the analysis should include 24 stocking plans from Region II and 12 stocking plans from Region III, which in total contained slightly more than 300 water bodies. The water bodies range from rivers stocked with anadromous species to small, urban ponds stocked with rainbow trout, arctic char, and grayling.

Calculate Estimated Angler days

Every year ADF&G conducts a mail survey of anglers who purchased an Alaska license within the last calendar year. This survey asks anglers to identify how many days they fished during the year and where they fished. ADF&G then uses the survey responses to estimate the annual fishing days and catch at survey-identified water bodies. The ADF&G survey is an ideal source of information for this type of study because it provides an established, reliable estimate of fishing effort over a number of years. However, not every water body covered by a stocking management plan receives enough survey responses to generate reliable results. For example, a very popular individual water body such as Ship Creek in Anchorage may generate dozens or even hundreds of survey results while smaller stocked water bodies in less populated areas may generate far fewer survey responses. Fewer responses make it harder for ADF&G to estimate the number of fishing days in a calendar year.

Many of the water bodies in the stocking plans did not have enough survey responses to support valid individual estimates of effort. The next best option to individual water body estimation is to aggregate survey responses at the stocking plan level. Using this method, the ADF&G could estimate an aggregate effort level for groups of water bodies that did not have enough individual responses to support estimates. ADF&G analysts provided this level of data and estimated the number of angler days for each plan on a yearly basis from 1998 through 2002. The analysis used data from multiple years to help account for yearly variation in survey responses.

Table 3 and Table 4 show the average estimated number of annual angler days, the average annual number of survey responses, and the percent of fishing days attributable to the stocking program.

Table 3 Region II Hatchery Programs

Plan	Plan Name	Fishing Type	Average Estimated Annual Days (1998-2002)	Average Survey Responses (1998-2002)	Percent Attributed to Hatchery Program	Average Days Attributed to the Hatchery Program
2.01	Northern Cook Inlet Chinook Salmon Enhancement	A	42,942	770	70%	30,059
2.02	Anchorage Urban Area Chinook/Coho Salmon Enhancement[4]	A	52,484	702	100%	52,484
2.03	Kasilof River/Crooked Creek Chinook Salmon Enhancement	A	37,934	927	30%	11,380
2.04	Kachemak Bay Area Salmon Enhancement	A	20,223	410	100%	20,223
2.05	Kodiak Area Road System Anadromous Chinook Enhancement	A	4,278	40	100%	4,278
2.06	Ninilchik River Salmon Enhancement	A	11,789	269	50%	5,895
2.07	PWS Chinook Salmon Enhancement	A	9,474	174	100%	9,474
2.08	Resurrection Bay Area Chinook Salmon Enhancement	A	64,000	288	50%	32,000
2.09	Northern Cook Inlet Urban Area Coho Salmon Enhancement	A	14,116	298	100%	14,116
2.10	Kachemak Bay Area Coho Salmon Enhancement	A	In Plan 2.04	In Plan 2.04	In Plan 2.04	In Plan 2.04
2.11	Kodiak Area Road System Anadromous Coho Enhancement	A	In Plan 2.05	In Plan 2.05	In Plan 2.05	In Plan 2.05
2.12	Resurrection Bay Coho Salmon Enhancement	A	In Plan 2.08	In Plan 2.08	In Plan 2.08	In Plan 2.08
2.13.1	Anchorage Area Non-anadromous Stocking Program	NA	24,423	413	100%	24,423
2.13.2	Chugiak/Eagle River Sub-District	NA	11,032	184	100%	11,032
2.13.3	Elmendorf Air Force Base Sub-District	NA	11,279	176	100%	11,279
2.13.4	Fort Richardson Army Base Sub District	NA	9,919	155	100%	9,919
2.13.5	Turnagain Arm Sub-District	NA	446	7	100%	446
2.14	Kenai Peninsula Stocked Lakes Management Plan	NA	7,199	124	80%	5,759
2.15	Kodiak Road System Landlocked Lake Enhancement	NA	802	16	80%	642
2.16	Finger Lake Management Plan	NA	7,002	103	100%	7,002
2.17	Kepler-Bradley Complex	NA	7,606	142	100%	7,606
2.18	Matanuska-Susitna Valley Small Lake Management Plan	NA	18,379	296	100%	18,379
2.19	PWS Area Lake Stocking Plan	NA	522	17	100%	522
2.20	Resurrection Bay Area Non-anadromous Stocking Program	NA	Unknown	0	Unknown	0

Source: ADF&G Statewide Harvest Survey 1998-2002. Notes: A= Anadromous; NA=Non-anadromous

The survey generated, on the average, a reasonable number of survey responses for nearly every plan. Plans 2.20 and 3.2.2 are exceptions. These plans had no responses from which to estimate fishing effort. Plans 2.11, 2.13.5, 2.19, 3.1.7, and 3.2.4 also had very low response levels. However, these plans make a minor contribution to the total angler days associated with the stocking program. They are included in our analysis.

[4] This stocking management plan manages the Ship Creek fishery in Anchorage. Estimates include both chinook and coho angling effort.

Table 4. Region III Hatchery Programs

Plan	Plan Name	Fishing Type	Average Estimated Annual Days (1998-2002)	Average Survey Responses (1998-2002)	Percent Attributed to Hatchery Program	Average Days Attributed to the Hatchery Program
3.1.1	Birch Lake Fishery Enhancement	NA	7,342	145	100%	7,342
3.1.2	Chena Lake Sport Fishery Enhancement	NA	6,465	101	100%	6,465
3.1.3	Harding Lake Sport Fishery Enhancement	NA	2,486	54	80%	1,989
3.1.4	PileDriver Slough Sport Fishery Enhancement	NA	5,939	76	50%	2,970
3.1.5	Lower Tanana Valley Urban Lakes Sport Fishery Enhancement	NA	6,199	60	100%	6,199
3.1.6	Lower Tanana Valley Rural Lakes Sport Fishery Enhancement	NA	6,169	114	100%	6,169
3.1.7	Lower Tanana Valley Remote Lakes Sport Fishery Enhancement	NA	730	20	100%	730
3.2.1	Quartz Lake Sport Fishery Enhancement	NA	11,836	201	100%	11,836
3.2.2	Upper Tanana Valley Urban Lakes Sport Fishery Enhancement	NA	Unknown	0	Unknown	0
3.2.3	Upper Tanana Valley Rural Lakes Sport Fishery Enhancement	NA	2,569	50	100%	2,569
3.2.4	Upper Tanana Valley Remote Lakes Sport Fishery Enhancement	NA	632	16	100%	632
3.3.1	Glenallen Lakes Sport Fishery	NA	3,174	69	100%	3,174

Source: ADF&G Statewide Harvest Survey 1998-2002.Notes: A= Anadromous; NA=Non Anadromous

Estimated Hatchery Percentages

It is very possible, even certain at some water bodies, that fishing effort would take place without the stocking program. The analysis determined what portion of the estimated angler days for each plan was attributable to stocking and what portion would have existed without it.

Some plans have very high levels attributable to the stocking program. For example, the lakes covered by Plan 2.13.1, Anchorage Area Non-anadromous Stocking Program, do not support large, naturally reproducing populations of common target species. These lakes would have little fishing pressure without the stocking program. For these lakes, the analysis assumes that 100 percent of the fishing days are attributable to stocking programs. However, Plan 2.1, the Northern Cook Inlet Chinook Salmon Enhancement Program, has both wild and stocked runs. That analysis assumes only 50 percent of the days at that location are attributable to the stocking program. ADF&G biologists provided these assumptions based on their experience with the individual fisheries (see Table 3 and Table 4).

Resident/Non-Resident Ratio

Resident and non-resident anglers spend different amounts of money on their "average" fishing day. This difference exists because their needs differ. Non-residents have higher expenditures than residents because they require higher levels of services such as lodging, meals, and guide services. Non-residents also account for a much higher portion of days at water bodies that are part of an anadromous stocking program. Anadromous fishing requires heavier (i.e. more expensive) tackle than most non-anadromous fishing. Thus, non-resident, non-anadromous days will tend to have a greater effect on the economy than any other type of day analyzed in the study.

ADF&G provided stocking plan-specific estimates of non-resident angler days based on responses to the 1998-2002 Annual Statewide Harvest Surveys. Ratios could not be calculated for anadromous

stocking programs. Instead, we used the ratio of non-resident angler days to total angler days (29.4 percent), found in the *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (Alaska Edition)*. This number is conservative because the *2001 National Survey* estimate includes all water bodies, not just the world-class anadromous areas.

Table 5. Region II Non-Resident Ratios

Plan	Plan Name	Average Non-Resident Portion 1998-2002 (%)
2.01	Northern Cook Inlet Chinook Salmon Enhancement	29.4
2.02	Anchorage Urban Area Chinook Salmon Enhancement	29.4
2.03	Kasilof River/Crooked Creek Chinook Salmon Enhancement	29.4
2.04	Kachemak Bay Area Salmon Enhancement	29.4
2.05	Kodiak Area Road System Anadromous Chinook Enhancement	29.4
2.06	Ninilchik River Salmon Enhancement	29.4
2.07	PWS Chinook Salmon Enhancement	29.4
2.08	Resurrection Bay Area Chinook Salmon Enhancement	29.4
2.09	Northern Cook Inlet Urban Area Coho Salmon Enhancement	29.4
2.10	Kachemak Bay Area Coho Salmon Enhancement	29.4
2.11	Kodiak Area Road System Anadromous Coho Enhancement	17.5
2.12	Resurrection Bay Coho Salmon Enhancement	29.4
2.13.1	Anchorage Area Non-anadromous Stocking Program	3.1
2.13.2	Chugiak/Eagle River Sub-District	3.6
2.13.3	Elmendorf Air Force Base Sub-District	5.8
2.13.4	Fort Richardson Army Base Sub District	3.7
2.13.5	Turnagain Arm Sub-District	6.7
2.14	Kenai Peninsula Stocked Lakes Management Plan	10.3
2.15	Kodiak Road System Landlocked Lake Enhancement	9.4
2.16	Finger Lake Management Plan	3.7
2.17	Kepler-Bradley Complex	2.3
2.18	Matanuska-Susitna Valley Small Lake Management Plan	5.8
2.19	PWS Area Lake Stocking Plan	37.2
2.20	Resurrection Bay Area Non-anadromous Stocking Program	0.0

Source: ADF&G Statewide Harvest Survey 1998-2002.

Table 6. Region III Non-Resident Ratio

Plan	Plan Name	Average Non-Resident Portion1998-2002 (%)
3.1.1	Birch Lake Fishery Enhancement	3.8
3.1.2	Chena Lake Sport Fishery Enhancement	4.1
3.1.3	Harding Lake Sport Fishery Enhancement	7.3
3.1.4	PileDriver Slough Sport Fishery Enhancement	7.7
3.1.5	Lower Tanana Valley Urban Lakes Sport Fishery Enhancement	2.8
3.1.6	Lower Tanana Valley Rural Lakes Sport Fishery Enhancement	15.6
3.1.7	Lower Tanana Valley Remote Lakes Sport Fishery Enhancement	28.0
3.2.1	Quartz Lake Sport Fishery Enhancement	5.1
3.2.2	Upper Tanana Valley Urban Lakes Sport Fishery Enhancement	0.0
3.2.3	Upper Tanana Valley Rural Lakes Sport Fishery Enhancement	8.8
3.2.4	Upper Tanana Valley Remote Lakes Sport Fishery Enhancement	11.1
3.3.1	Glenallen Lakes Sport Fishery	13.7

Source: ADF&G Statewide Harvest Survey 1998-2002.

Fishing Day Expenditures

The number of angler days attributable to stocking program multiplied by the average fishing-related expenditures per angling day provides an estimate of angling-related expenditures attributable to the stocking program.

In order to perform the calculation described above, we developed lower and upper bound estimates of per day economic expenditures based on residency status (i.e. resident and non-resident). The analysis divided all angler days into resident and non-resident days because local anglers spend less per day than non-resident anglers, as non-resident anglers are more likely to use guide services, to need lodging, and to spend more in restaurants.

We also estimated different values for anadromous and non-anadromous fishing days. Anadromous fishing generally requires heavier, more expensive equipment than non-anadromous fishing. Guide services are also very common in anadromous fishing. Anglers, particularly urban anglers, may have to drive further to get to an anadromous site than a stocked non-anadromous site. These factors result in a more expensive fishing day and higher expenditures. The estimates, taken together, create a conservative range of the estimated value of the Region II and III stocking programs.

Our primary sources for these estimates were *An Economic Assessment of the Sport Fisheries for Halibut, and Chinook and Coho Salmon in Lower and Central Cook Inlet*, by Herrmann et al. (2001) and *The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (Alaska Edition)* by the U.S. Department of the Interior. Both sources are Alaska-specific research conducted within the last five years. Herrmann et al., conducted in 1999, based their expenditure estimates on a University of Alaska-Fairbanks study of Cook Inlet anglers, while the U.S. Department of Interior's estimates are based on the National Recreation Survey.[5] These reports are the most relevant possible sources of per day expenditure estimates for this study because they are based on recent research and are Alaska-specific. These features make them far more applicable than older research conducted in

[5] All values based on this study were adjusted to 2001 dollars.

other parts of the country.[6] Table 7 shows estimated economic expenditures for each type of fishing day.

Table 7. Fishing Day Expenditures

Day Type	Resident	Non-Resident
Anadromous Day (Lower Bound)	$41.12	$136.90
Anadromous Day (Upper Bound)	$87.64	$297.13
Non-Anadromous Day (Lower Bound)	$19.03	$32.19
Non-Anadromous Day (Upper Bound)	$78.88	$267.41

Note: All Values are in 2001 dollars.

Lower Bound Anadromous Expenditure Estimate

The lower bound estimates of anadromous expenditures, for both residents and non-residents, come directly from Herrmann et al. (2001).[7] We use the study's estimated value for shore-based anadromous angling expenditures as our anadromous lower bound. The lower bound estimate for an average anadromous day is $41.12 of expenditures for resident anglers and $136.90 for non-resident anglers. This value is relevant to this study because Herrmann et al. use data from anglers fishing at several stocked water bodies from Region II.

Lower Bound Anadromous Expenditure Estimate

The lower bound non-anadromous estimates are derived from the Herrmann et al. (2001) estimate of anadromous shore-based fishing, and confirmed using data from the USDOI (2001) study. Neither of these studies provides an explicit estimate of non-anadromous expenditures for fishing day that we could use as lower bound. Thus, we used average fuel, groceries, and bait expenditures for anadromous shore-based days from Herrmann et al. (2001) as a proxy non-anadromous fishing expenditures.[8] The lower bound estimate for an average anadromous day is $19.03 of expenditures for resident anglers and $32.19 for non-resident anglers. We confirmed this value by using our second source, *The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (Alaska Edition)*. The same methodology applied to this study's estimates of daily freshwater angler expenditures on fuel, groceries, and bait expenditures provided a similar estimate.

Upper Bound Anadromous and Non-Anadromous Expenditure Estimates

The analysis derived upper bound estimates for both anadromous and non-anadromous days from the *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (Alaska Edition*) by the U.S. Department of Interior (2001). We used the study's estimates of total resident & non-resident freshwater fishing days, total resident & non-resident saltwater fishing days, average freshwater expenditures per day, and average saltwater expenditures per day to create an estimate of anadromous and non-anadromous expenditures for residents and non-residents. We used freshwater expenditures as a proxy for non-anadromous days and saltwater days as a proxy for anadromous days. We believe that this assumption is reasonable because non-anadromous fishing days attributable to the stocking programs occur in freshwater while many anadromous fishing days attributable to the program occur in estuarine or riverine conditions utilizing tackle similar to that used for saltwater

[6] These values are also comparable to prior Alaska studies such as Duffield, 1996, Duffield et al. 2001a, Duffield et al. 2001b, and Duffield et al. 2001c.

[7] The estimates are adjusted for inflation to convert the study's results from 1999 $US to 2001 $US.

[8] The study team selected fuel, groceries, and bait because these elements are common to both anadromous and non-anadromous fishing. For example, an anadromous fishing trip would consume the same amount of fuel as a non-anadromous trip to a similar location.

fishing. The upper bound estimate for an average anadromous day is $87.64 of expenditures for resident anglers and $297.13 for non-resident anglers. The upper bound estimate for an average non-anadromous day is $78.88 of expenditures for resident anglers and $267.41 for non-resident anglers.

Non-Resident Multiplier

We use a multiplier to transform the direct expenditures associated with a fishing day to the economic effect of a fishing day on the Alaska economy. Multiplier effects are comprised of the direct, indirect, and induced effects.

Direct effects are the changes in industries to which a final demand change was made. For example, if anglers demand guide services, then guides profit from those expenditures. Indirect effects are the changes in inter-industry purchases as they respond to the new demands of the directly affected industries. For example, if a guide experiences an increase in demand and purchases bait from another supplier, then the bait supplier also benefits from increased demand. Induced effects reflect changes in spending from households as income increases or decreases because of the changes in demand. For example, the guide may spend more at restaurants if his income is higher.

The magnitude of economic impacts (measured using multipliers) depends on the amount of local expenditures by non-residents and multipliers with the sectors directly affected (e.g. guide services, fuel stations, hospitality industries). It is assumed that residents would substitute their angling-related spending on other recreational activities if they did not spend it on sport fishing. In other words, their disposable income would be spent on something else in the Alaska economy if it were not spent on sport fishing. Therefore, their multiplier is not included for purposes of effect analysis. Non-resident anglers bring new money to the Alaska economy. Their disposable income could be spent in Alaska on angling or it could be spent on restaurants in some other state. Thus, we use the multiplier to determine what effect their angling-related spending on has on the Alaska economy.

The output multiplier for this analysis is 1.486; this means that every dollar spent by non-resident sport-fishers in the state generates 49 cents of additional sales, or total economic activity, in the economy.

Calculation and Aggregation

The second-to-last step in the analysis is to run the calculations and aggregate the results over each management plan. This step provides us with the values seen in Table 1 and Table 2.

Discount Rate

We also calculated the present value of the program over the next 20 years (see Table 8 and

Table 9). We performed calculations using two different discount rates, each of which we applied to the average aggregate number estimated in the previous step. The first discount rate is 3.5 percent. The source for this discount rate is the federal government's Office of Management and Budget (OMB 2004). The rate is their 30-year rate for all federal projects. The other discount rate is more state specific. We used the Alaska Permanent Fund's real rate of return over the past decade (5.3 percent). This rate represents the State of Alaska's opportunity cost for funding the hatchery program rather than investing the money in the Permanent Fund. Our results were relatively insensitive to the difference between these two rates.

Table 8. Lower Bound Present Value Estimates

Year	Lower Bound Resident Present Value	Lower Bound Non-Resident Present Values	Total Lower Bound Present Values
1	$7,929,813	$11,278,283	$19,208,097
2	$7,661,655	$10,896,892	$18,558,547
3	$7,402,565	$10,528,398	$17,930,964
4	$7,152,237	$10,172,366	$17,324,603
5	$6,910,374	$9,828,372	$16,738,747
6	$6,676,690	$9,496,012	$16,172,702
7	$6,450,908	$9,174,891	$15,625,799
8	$6,232,761	$8,864,629	$15,097,390
9	$6,021,992	$8,564,859	$14,586,851
10	$5,818,350	$8,275,226	$14,093,575
11	$5,621,594	$7,995,387	$13,616,981
12	$5,431,492	$7,725,012	$13,156,503
13	$5,247,818	$7,463,780	$12,711,598
14	$5,070,355	$7,211,381	$12,281,737
15	$4,898,894	$6,967,518	$11,866,412
16	$4,733,231	$6,731,902	$11,465,133
17	$4,573,170	$6,504,253	$11,077,423
18	$4,418,522	$6,284,302	$10,702,824
19	$4,269,103	$6,071,790	$10,340,893
20	$4,124,737	$5,866,463	$9,991,201
Total	**$116,646,262**	**$165,901,716**	**$282,547,978**

Source: Analysis Estimates, 2001 Dollars

Table 9. Upper Bound Present Value Estimates

Year	Upper Bound Resident Present Value	Upper Bound Non-Resident Present Values	Total Upper Bound Present Values
1	$22,226,605	$26,871,257	$49,097,862
2	$21,474,981	$25,962,567	$47,437,548
3	$20,748,774	$25,084,606	$45,833,380
4	$20,047,124	$24,236,334	$44,283,459
5	$19,369,202	$23,416,748	$42,785,951
6	$18,714,205	$22,624,878	$41,339,083
7	$18,081,358	$21,859,785	$39,941,143
8	$17,469,911	$21,120,565	$38,590,476
9	$16,879,141	$20,406,343	$37,285,484
10	$16,308,349	$19,716,274	$36,024,622
11	$15,756,859	$19,049,540	$34,806,398
12	$15,224,018	$18,405,352	$33,629,370
13	$14,709,196	$17,782,949	$32,492,145
14	$14,211,784	$17,181,593	$31,393,377
15	$13,731,192	$16,600,573	$30,331,765
16	$13,266,852	$16,039,201	$29,306,053
17	$12,818,215	$15,496,813	$28,315,028
18	$12,384,748	$14,972,766	$27,357,514
19	$11,965,940	$14,466,441	$26,432,381
20	$11,561,295	$13,977,237	$25,538,533
Total	**$326,949,748**	**$395,271,825**	**$722,221,574**

Source: Analysis Estimates, 2001 Dollars

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Appendix A-Program Specific Estimates of Economic Effect

Table 10. Region II Hatchery Program Economic Effects

Plan	Plan Name	Average Days Attributed to the Hatchery Program	Average Days Attributed to the Hatchery Program	Estimated Average Resident Effect Per Year	Estimated Average Non-Resident Effect Per Year
2.01	Northern Cook Inlet Chinook Salmon Enhancement	30,059	$1,366,262	$2,849,923	$4,216,185
2.02	Anchorage Urban Area Chinook & Coho Salmon Enhancement	52,484	$2,385,536	$4,976,055	$7,361,590
2.03	Kasilof River/Crooked Creek Chinook Salmon Enhancement	11,380	$517,261	$1,078,970	$1,596,231
2.04	Kachemak Bay Area Salmon Enhancement	20,223	$919,163	$1,917,308	$2,836,471
2.05	Kodiak Area Road System Anadromous Chinook Enhancement	4,278	$194,427	$405,560	$599,987
2.06	Ninilchik River Salmon Enhancement	5,895	$267,914	$558,849	$826,763
2.07	PWS Chinook Salmon Enhancement	9,474	$430,624	$898,250	$1,328,874
2.08	Resurrection Bay Area Chinook Salmon Enhancement	32,000	$1,454,473	$3,033,925	$4,488,398
2.09	Northern Cook Inlet Urban Area Coho Salmon Enhancement	14,116	$739,077	$1,541,661	$2,280,737
2.10	Kachemak Bay Area Coho Salmon Enhancement	In Plan 2.04	In Plan 2.04	In Plan 2.04	In Plan 2.04
2.11	Kodiak Area Road System Anadromous Coho Enhancement	In Plan 2.05	In Plan 2.05	In Plan 2.05	In Plan 2.05
2.12	Resurrection Bay Coho Salmon Enhancement	In Plan 2.08	In Plan 2.08	In Plan 2.08	In Plan 2.08
2.13.1	Anchorage Area Non-anadromous Stocking Program	24,423	$1,158,076	$170,709	$1,328,784
2.13.2	Chugiak/Eagle River Sub-District	11,032	$520,880	$87,176	$608,056
2.13.3	Elmendorf Air Force Base Sub-District	11,279	$520,156	$145,628	$665,784
2.13.4	Fort Richardson Army Base Sub District	9,919	$467,530	$82,139	$549,669
2.13.5	Turnagain Arm Sub-District	446	$20,394	$6,638	$27,032
2.14	Kenai Peninsula Stocked Lakes Management Plan	5,759	$253,021	$131,538	$384,560
2.15	Kodiak Road System Landlocked Lake Enhancement	642	$28,440	$13,433	$41,873
2.16	Finger Lake Management Plan	7,002	$330,271	$56,891	$387,163
2.17	Kepler-Bradley Complex	7,606	$363,993	$38,097	$402,090
2.18	Matanuska-Susitna Valley Small Lake Management Plan	18,379	$847,630	$236,876	$1,084,507
2.19	PWS Area Lake Stocking Plan	522	$16,054	$43,242	$59,297
2.20	Resurrection Bay Area Non-anadromous Stocking Program	0	0	0	0

Source: ADF&G Statewide Harvest Survey 1998-2002. Notes: A= Anadromous; NA=Non-anadromous

Table 11. Region III Hatchery Programs Economic Effects

Plan	Plan Name	Average Days Attributed to the Hatchery Program	Estimated Average Resident Effect Per Year	Estimated Average Non-Resident Effect Per Year	Estimated Average Total Angling Effect Per Year
3.1.1	Birch Lake Fishery Enhancement	7,342	$345,680	$62,599	$408,279
3.1.2	Chena Lake Sport Fishery Enhancement	6,465	$303,527	$59,006	$362,533
3.1.3	Harding Lake Sport Fishery Enhancement	1,989	$90,298	$32,190	$122,488
3.1.4	PileDriver Slough Sport Fishery Enhancement	2,970	$134,183	$50,900	$185,083
3.1.5	Lower Tanana Valley Urban Lakes Sport Fishery Enhancement	6,199	$294,925	$38,773	$333,699
3.1.6	Lower Tanana Valley Rural Lakes Sport Fishery Enhancement	6,169	$254,852	$214,355	$469,208
3.1.7	Lower Tanana Valley Remote Lakes Sport Fishery Enhancement	730	$25,738	$45,557	$71,295
3.2.1	Quartz Lake Sport Fishery Enhancement	11,836	$549,871	$134,369	$684,240
3.2.2	Upper Tanana Valley Urban Lakes Sport Fishery Enhancement	0	0	0	0
3.2.3	Upper Tanana Valley Rural Lakes Sport Fishery Enhancement	2,569	$114,669	$50,500	$165,169
3.2.4	Upper Tanana Valley Remote Lakes Sport Fishery Enhancement	632	$27,496	$15,658	$43,154
3.3.1	Glenallen Lakes Sport Fishery	3,174	$134,190	$96,455	$230,645

Source: ADF&G Statewide Harvest Survey 1998-2002.Notes: A= Anadromous; NA=Non Anadromous